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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/967,044	09/28/2001	Douglas T. Grider	TI-31118	4815

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TEXAS INSTRUMENTS INCORPORATED
P O BOX 655474, M/S 3999
DALLAS, TX 75265

EXAMINER	
MALDONADO, JULIO J	
ART UNIT	**PAPER NUMBER**
2823	

DATE MAILED: 02/24/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/967,044	GRIDER, DOUGLAS T.	
	Examiner	Art Unit	
	Julio J. Maldonado	2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 October 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-8 and 14-17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-8 and 14-17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. The addition of claims 14-17 is acknowledged.

2. The cancellation of claims 9 and 10 is acknowledged.

3. Applicants made no argument regarding the patentability in amendment filed on 10/20/2003. See MPEP 714.04.

4. Claims 1-8 and 14-17 are pending in the application.

Continued Examination Under 37 CFR 1.114

5. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 10/20/2003 has been entered.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 1-3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsunoda (U.S. 5,698,464) in view of Kraft et al. (U.S. 6,136,654).

Tsunoda (Figs.1-6) in a related method to form an oxynitride layer teaches the steps of providing a semiconductor substrate (1); forming an oxide layer (12) on the

semiconductor substrate (1); incorporating nitrogen into the oxide layer (12) thereby converting the oxide layer (12) to an oxynitride layer (14); and annealing said oxynitride layer (14) in N_2O to form an oxynitride layer with a uniform nitrogen concentration profile, wherein said annealing comprises rapid thermal annealing at a temperature of 1,000°C for 60 seconds (column 2, line 55 – column 4, line 10).

Tsunoda fails to expressly teach wherein annealing the oxynitride layer in N_2O comprises rapid thermal annealing at a temperature of 800 – 1,100°C for 10 – 60 seconds. However, in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. MPEP 2144.05. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the temperature and time disclosed in the teachings of Tsunoda to arrive at the claimed invention.

Still, Tsunoda fails to teach incorporating nitrogen by exposing the oxide layer to a high-density nitrogen plasma. However, Kraft et al. (Figs.1-2) in a related method to form a gate oxynitride structure teach the steps of forming a gate oxide layer (14) and exposing the oxide layer to a high-density nitrogen plasma (column 3, line 58 – column 5, line 60). Therefore, it would have been obvious to one of ordinary skill in the art at the of the invention was made to form the silicon oxynitride layer as taught by Kraft in the method of Tsunoda, since this would result in a dielectric layer substantially free of contaminants (e.g. hydrogen) (column 2, lines 44-45).

Furthermore, the combined teachings of Tsunoda and Kraft et al. fail to teach wherein the nitrogen concentration in said oxynitride layer is less than 10% variation

across the oxide layer. However, the same material would be treated in the same manner and therefore the recited results would be obtained.

Furtherstill, Tsunoda in combination with Kraft et al. fail to teach applying the high-density plasma at a power level of 700 – 900 watts. However, the selection of the claimed range is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the above-mentioned range to arrive to the claimed invention.

8. Claims 4, 8 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tobin et al. (U.S. 5,972,804) in view of Tsunoda ('464).

Tobin et al. (Figs.13-18) in a related method to form a field effect transistor structure teach the steps of providing a semiconductor substrate (13); forming a gate dielectric layer (23) on the semiconductor substrate (13), wherein the dielectric layer (23) has a physical thickness between 25 Å and 100Å (column 5, lines 49 – 53); forming a conductive layer (43) on said gate dielectric layer (23); forming sidewall structures (54) adjacent to said conductive layer (23); and forming source and drain regions (56) in the semiconductor substrate (13) adjacent to said sidewall (54) structures (column 12, line 36 – column 14, line 6).

Still, the teachings of Tobin et al. fail to expressly teach wherein the thickness of the dielectric layer is less than 40Å. However, in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. MPEP 2144.05. Therefore, it would have been obvious to one of

ordinary skill in the art at the time the invention was made to use the thickness range disclosed in the teachings of Tobin et al. to arrive at the claimed invention.

Still, Tobin et al. fail to teach wherein the gate dielectric layer has a uniform nitrogen concentration. However, Tsunoda (Figs.1-6) in a related method to form a dielectric layer teach providing a substrate (11); and forming a dielectric layer (12) over the substrate (11), wherein the gate dielectric layer (12) has a uniform nitrogen concentration (column 2, line 55 – column 4, line 10). It would have been within the scope of one of ordinary skill in the art to combine the teachings of Tobin et al. and Tsunoda to enable the dielectric layer forming step of Tobin et al. to be performed according to the teachings of Tsunoda because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable methods of performing the disclosed dielectric formation step of Tobin et al. and art recognized suitability for an intended purpose has been recognized to be motivation to combine (MPEP 2144.07), and furthermore because this would reduce the leakage of the formed gate oxide (column 1, lines 32 – 60).

Furtherstill, the combined teachings of Tobin et al. and Tsunoda fail to teach wherein the gate dielectric layer has a nitrogen concentration with less than 10% variation across the gate dielectric layer. However, the same material would be treated in the same manner and therefore the recited results would be obtained.

However, the combined teachings of Tobin et al. and Tsunoda substantially teach all aspects of the invention but fail to show that said uniform nitrogen concentration is greater than 6 atomic percent. However, the selection of the claimed

range is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the above-mentioned range to arrive to the claimed invention.

9. Claims 5-7 and 15-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tobin et al. ('804) in view of Tsunoda ('464) as applied to claims 4 above, and further in view of Kraft et al. ('654).

Tobin et al. in combination with Tsunoda teach forming an oxide layer on the semiconductor substrate; incorporating nitrogen into the oxide layer thereby converting the oxide layer to an oxynitride layer; and annealing said oxynitride layer in N_2O to form an oxynitride layer with a uniform nitrogen concentration profile, wherein said annealing comprises rapid thermal annealing at a temperature of 1,000°C for 60 seconds (Tsunoda, column 2, line 55 – column 4, line 10).

The combined teachings of Tobin et al. and Tsunoda fail to expressly teach wherein annealing the oxynitride layer in N_2O comprises rapid thermal annealing at a temperature of 800 – 1,100°C for 10 – 60 seconds. However, in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. MPEP 2144.05. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the temperature and time disclosed in the teachings of Tsunoda to arrive at the claimed invention.

Still, the combined teachings of Tobin et al. and Tsunoda fail to teach incorporating nitrogen by exposing the oxide layer to a high-density nitrogen plasma.

However, Kraft et al. (Figs.1-2) in a related method to form a gate oxynitride structure teach the steps of forming a gate oxide layer (14) and exposing the oxide layer to a high-density nitrogen plasma (column 3, line 58 – column 5, line 60). Therefore, it would have been obvious to one of ordinary skill in the art at the of the invention was made to form the silicon oxynitride layer as taught by Kraft in the method of Tobin et al. and Tsunoda, since this would result in a dielectric layer substantially free of contaminants (e.g. hydrogen) (column 2, lines 44-45).

Furtherstill, the combined teachings of Tobin et al., Tsunoda and Kraft et al. fail to teach applying the high-density plasma at a power level of 700 – 900 watts. However, the selection of the claimed range is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the above-mentioned range to arrive to the claimed invention.

Conclusion

10. Any inquiry of a general nature or relating to the status of this application should be directed to the Group Receptionist whose telephone number is 571-272-2800. See MPEP 203.08.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner George Fourson whose telephone number is (571) 272-1860. The examiner can normally be reached on Monday through Friday.

12. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri, can be reached on (571) 272-1855. The fax number for this group is 703-872-9306 for before final submissions, 703-872-9306 for after final submissions and the customer service number for group 2800 is (703) 306-3329. Updates can be found at http://www.uspto.gov/web/info/2800.htm.

George Fourson
Primary Examiner
Art Unit 2823

Julio J. Maldonado
February 11, 2004